

**Dreaming activities: associations between alcohol consumption and
frequency of nightmares and bad dreams**

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Preface

The current bachelor thesis is a final part of the three-year bachelor's program in psychology at Norwegian University of Science and Technology. The theme of the study concerns alcohol and nightmare, and the research question was chosen freely within the framework of the project description. I would like to thank my supervisions, professor Wei Wang who led the bachelor project, and Torhild Anita Sørengaard for her helpfulness and guidance from the middle of April until the end of the bachelor project. She has answered all questions and been widely available throughout this period which has been of immense help. I would also like to thank the assistants of the project, Tiffany Lussier and Eline Eyde Lüder-Larsen, for their guidance throughout the duration of the bachelor project and for conducting the questionnaire used in the current bachelor project.

Abstract

The present study aims to investigate whether alcohol consumption is associated with the higher frequencies of nightmares and bad dreams. There exists an insufficient number of studies investigating the association between these elements, although it is a huge need due to the notion that both alcohol use and occurrence of nightmares may incur mental disorder and may lead to distress and reduced well-being among individuals across the world. 87 participants were included in the study where they were supposed to fill out an electronic questionnaire about their dreams every day for four weeks. Non-significant negative weak correlations were found. Nor did alcohol consumption obtain a significant predictive ability on frequency of nightmares and bad dreams. The hypothesis of a positive correlation between alcohol consumption and frequency of nightmares and bad dreams could not be supported by the results. Methodological limitations were discussed in conjunction with implications for future research. The need to further examine the relationship exists, in addition to considering other potential explanatory factors which can contribute to a holistic understanding of the phenomena. Contribution with health promotion work and preventive measures can occur through extended knowledge on how these elements work together.

1. Introduction

Alcohol tendencies are increasing across the world despite the damage it inflicts on both individuals and the society. Between 1985 and 2019 the proportions of adults in Norway who drink alcohol and who drink alcohol relatively often have substantially increased (Bye & Moan, 2020). Likewise, there has been an increase in alcohol consumption for the last 20 years in America. For example, from 1999 to 2017, the number of alcohol-related deaths among women has increased 85 percent (Schmidt, 2020). One reason for the rising tendencies in alcohol consumption, is its use as self-treatment for insomnia because of its effect to decrease the time required to fall asleep (Steinig et al., 2011). Insomnia is the most prevalent sleep disorder and carries a heavy burden for patients as evidenced by its effect on psychological domains and quality of life (Morin & Benca, 2012). There is also evidence to suggest that alcohol consumption increase the opportunity for nightmares to occur, and that it might be a correlation between nightmare and alcohol (Rek et al., 2017). Experiencing nightmares causes several effects which negatively influence individual's life, including reduced well-being and health (Zadra & Donderi, 2000), and increased distress (Nielsen & Zadra, 2005). Given the suggestion that drinking alcohol has an effect on experiencing nightmares, the aim of the current study is to scrutinize this relation to better apprehend the correlation between alcohol consumption and the occurrence of nightmares. A better understanding of the relation between alcohol and nightmares may provide insight into how these elements work together, and thereby may provide improved statistics on alcohol tendencies and nightmare frequencies. This further elucidates how better understanding of their relationship might lead to improved well-being among individuals and decrease distress in everyday life. However, an inadequate number of studies establishing the relation between alcohol and nightmare frequencies currently exist.

1.1 Sleep

Sleep is a state of the brain characterized by a cyclic alternating pattern of non-rapid eye movement (non-REM) sleep and rapid eye movement (REM) sleep (Acharya et al., 2005). Non-REM sleep encompasses the deeper sleep (Acharya et al., 2005), and is associated with maintenance of sleep and sleep quality. It is considered to be the most restorative sleep stage (Dijk, 2019). The EEG during non-REM sleep is more synchronized than during REM-sleep (Oudiette et al., 2012). REM sleep is several things, including dream state, behavioral state and brain state produced by complex anatomically distributed neural circuits that provides several individual components (Blumberg et al., 2020). REM sleep is a highly activated state

of the brain (Acharya et al., 2005), of which most dreams occur (Aime et al., 2022). This state of brain is similar to a waking-like EEG pattern coupled with skeletal motor atonia and is therefore often referred to as “active sleep” (Peever & Fuller, 2017). Several functions serve from REM sleep, for example is hippocampal neural activity during REM sleep critically involved in memory consolidation (Peever & Fuller, 2017). Both qualitative and quantitative differences have been observed between mental activity collected after REM sleep and non-REM sleep, of which the percent recall of dreaming is much lower after non-REM sleep (5-74%) than after REM-sleep (an average of 80%) (Oudiette et al., 2012).

1.2 Dreams

There is evidence to suggest that dreams closely reflect functions and the organization of the brain, they are not created in a vacuum (Nir & Tononi, 2010). As mentioned, the EEG looks similar during REM sleep and active waking. At times, the dreamers might be uncertain whether they are asleep or awake (Nir & Tononi, 2010). Additionally, Positron Emission Tomography (PET) studies show that global brain metabolism is comparable between REM sleep and wakefulness (Nir & Tononi, 2010). However, there is currently no convincing explanation for what we dream about or why we dream (Payne & Nadel, 2004). Some researchers focus on the relationship between memory, sleep and dream, of which dreams reflect a biological process of long-term memory consolidation – hippocampus is thought to play a significant role in consolidation of memories (Payne & Nadel, 2004). This process strengthens the neural traces of recent events intentionally to integrate previously stored knowledge and older memories with these new traces, and to maintain the stability of existing memory representations when subsequent information and experience is obtained (Payne & Nadel, 2004). If this, the content of dreams reflects some aspects of memory consolidation taking place during the various stages of sleep (Payne & Nadel, 2004).

Furthermore, many studies demonstrate that REM sleep is characterized by a particular pattern of regional brain activity, as compared to wakefulness and non-REM sleep (Desseilles et al., 2011). It is thought that this heterogeneous distribution of brain activity during sleep illustrate many typical features in dreams. Reciprocally, particular dream characteristics activate selective brain regions during sleep. Thus, different features of dreaming reflect activation in different brain regions (Desseilles et al., 2011). There are several structures activated during REM sleep, including thalamic nuclei, structures within the basal forebrain and the brainstem, anterior cingulate, amygdala and hippocampus (Oudiette et al., 2012). Moreover, evidence from recent neuroimaging demonstrates a selective inactivation during

REM sleep of portions of the frontal cortex, of which a prominent decrease in activity of the dorsolateral prefrontal cortex is observed (Payne & Nadel, 2004). Disruption in dorsolateral prefrontal cortex is associated with confabulatory syndromes that in various ways resemble dreaming (Payne & Nadel, 2004). Deactivation in prefrontal cortex could be related to the fragmented nature of dreams. Additionally, deactivation of prefrontal regions may underlie the tendency to accept bizarre themes and dream fragments as normal and commonplace (Payne & Nadel, 2004; Oudiette et al., 2012). Furthermore, there has been established a strong activation of high-order occipito-temporal visual cortex in REM sleep, consistent with the vivid visual imagery during dreams (Nir & Tononi, 2010). Also, several motor brain regions, including premotor cortices and primary motor cortices, are activated during REM sleep, likewise the basal ganglia and the cerebellum (Desseilles et al., 2011). These conclusions are in line with the motor content of dreams (Desseilles et al., 2011).

1.3 Nightmares

Nightmares are the most prevalent dream disturbance (Nielsen & Zadra, 2005). A nightmare is a dream involving a perturbation of emotional expression during sleep, associated with a variety of dysphoric and negative emotions, such as anger, anxiety and fear, which results in frequent awakenings (Munezawa et al., 2011; Nielsen & Zadra, 2005). Nightmare can disrupt the maintenance of REM sleep, due to the content of the dream which is highly emotionally-loaded (Desseilles et al., 2011). Nightmares prevent restorative sleep, are inherently distressing, and are now recognized to be associated with a number of psychiatric problems (Rek et al., 2017). Poor health, daytime distress and higher risk for suicide are associated with patients experiencing nightmares (Campbell & Germain, 2016). A study conducted by Zadra and Donderi (2000) concluded that frequency of nightmares significantly correlates more with the measures of psychological well-being than frequency of bad dreams did. A direct examination of the correlation between measures of well-being and bad dream frequency versus nightmare frequency established that well-being accounted for approximately 4% of the variance in bad-dream frequency versus approximately 13% of the variance in nightmare frequency (Zadra & Donderi, 2000). This might be confounding findings due to the notion that people who drink alcohol often are more likely to have diminished well-being essentially. However, nightmares have most often been considered in the context of post-traumatic stress disorder (PTSD) since stressful events are generally considered as the key trigger of nightmares (Rek et al., 2017). Individuals suffering with PTSD also suffer from insomnia due to a cognitive hyperarousal at sleep onset. This might reflect an abnormal activation of brain

networks in these patients during sleep, which might also occur when experiencing nightmares (Desseilles et al., 2011). Approximately 50-90% of the general population experience nightmares at some time in life. The results from a study on Japanese adolescents revealed that the prevalence of nightmares in adolescents was 35.2% (Munezawa et al., 2011). Additionally, two surveys on children aged 5-12 years publicized that during the previous 6 months, 20-30% of the children had experienced nightmares at least once (Munezawa et al., 2011).

However, a holistic and comprehensive definition of nightmare currently do not exist. It is challenging differentiating from bad dreams, due to its interpretive subjectivity. Anyway, most of the definitions of nightmare include frequent awakenings as a requirement (Blagrove et al., 2004). Bad dreams involve negative emotions and events, as nightmares, but are not the reason the dreamer wakes up (Blagrove & Haywood, 2006). That means, the awakening criterion does not exist. Consequently, people experiencing a horrible and fear inducing dream without awakenings will probably define it as a nightmare while other who are aware of the definition will consider it as a bad dream.

1.4 Previous research

1.4.1 Alcohol and nightmares

There are evidence reporting that patients with alcohol abuse have dreams that is described more negatively toned (Steinig et al., 2011), and that the association between alcohol consumption and nightmare is high (Munezawa et al., 2011). Certainly, based on several studies, it exists an association between alcohol consumption and poor sleep, including interrupted and shallow sleep (Munezawa et al., 2011). The sleep architecture is fragmented and both sleep architecture and sleep quality will be strongly impacted in a negative way. In patients with chronic alcohol abuse, the total amount of non-REM sleep is reduced, the number of nocturnal awakenings and sleep stage shifts are increased, and sleep efficiency and latency are decreased (Steinig et al., 2011). Moreover, alcohol consumption affects the time spent in rapid eye movement (REM) sleep (Steinig et al., 2011). The amount of REM sleep increases by cause of alcohol consumption, and there is evidence that alcohol-induced REM-sleep suppression during the first half of the night causes REM sleep rebound in the second half of the sleep period (Rek et al., 2017). Mentation reports obtained after REM sleep awakenings tend to be longer, emotionally charged, more bizarre, more hallucinatory and more vivid than after non-REM sleep awakenings (Oudiette et al., 2012). Consequently, more vivid, emotionally charged and longer dreams increase the opportunity for nightmare to occur

during REM sleep (Rek et al., 2017). Furthermore, there are studies indicating negative effects on sleep after only two doses of alcohol ingestion, which reflects “normal” social drinking (Feige et al., 2006). A single-blind randomized design in healthy volunteers conducted by Feige et al. (2006) showed that after this dose, alcohol significantly reduced REM sleep density in the beginning of the night and increased non-REM sleep in the first half of a night of sleep.

1.4.2 Alcohol affects cerebral activation

Due to the theory that different features of dreaming reflect activation in different brain regions, alcohol will theoretically influence dreaming since alcohol consumption certainly affects cerebral activation (Squeglia et al., 2014). Alcohol causes significant neuropathology and affects cerebral activation throughout the brain including cerebellum, hippocampus, and cerebral cortex (Drew et al., 2015). Alcohol exposure of cerebral cortex and the hippocampus leads to deficits in memory, learning, emotion and executive function (Drew et al., 2015). There has been documented that chronic alcoholic patients have a loss of neurons in the frontal cortex, in addition to a reduction in the mean size of the neuronal soma in both motor cortices and the superior frontal cortices (Harper & Kril, 1989). Moreover, studies have reported an association between alcohol-dependent subjects and reduction in amygdala (Wrase et al., 2008). Wrase et al. (2008) found amygdala reduction in long-term alcohol-dependent subjects. Amygdala is a structure in the brain, critically involved in emotional regulation (Aziz & Green, 2016). Neuroanatomical results demonstrate that nightmares in rats include activation of the amygdala (Yu et al., 2015), which can be an explanatory factor of the emotional component in nightmares. Additionally, findings from neuroimaging suggest that the average dream of individuals with bilateral amygdala damage is more pleasant, significantly simpler and less likely to be a nightmare than the average control dream (Blake et al., 2019). This indicates amygdala significantly plays a role in the emotional component of dreams.

Wrase et al. (2008) also observed volume reductions in subiculum region of the hippocampus in all alcohol-dependent subjects in relation to healthy comparison subjects, which is a structure critically involved in memory consolidation (Payne & Nadel, 2004). Furthermore, there is evidence to suggest that alcohol consumption also effects volume asymmetries in hippocampus. Several differences between the brains of non-exposed and alcohol-exposed individuals have been revealed by imaging studies using MRI (Mattson et al., 2001). An MRI study of children with Fetal Alcohol Syndrome (FAS), a child condition resulting from

alcohol exposure during the mother's pregnancy which causes growth problems and brain damage (Mayo Clinic, 2018), demonstrated volume asymmetries in the hippocampus. The absolute volume of the hippocampus in the right temporal lobe was bigger than that of the corresponding area in the left temporal lobe (Mattson et al., 2001). Such differences also exist in individuals with normal neurological function, but the extent of the asymmetry was greater in children with FAS compared to the control children. Behavioral studies support the hypothesis that hippocampus might be affected in children with parental alcohol exposure. Individuals with parental alcohol exposure have been reported to exhibit deficits in memory functions associated with hippocampus (Mattson et al., 2001).

1.4.3 Dreams and neuromodulators

There are various neuromodulators in memory consolidation and sleep, including cortisol, which influence many of the brain systems involved in memory, which hypothetically is involved in dreams (Payne & Nadel, 2004). A hypothetical explanation is that the concentration of cortisol escalates over the course of the night's sleep leading to the changing nature of dreams across the sleep cycle. These variations in cortisol determine the functional status on the circuits of hippocampal and neocortical and by that influencing the processes of memory consolidation that transpire during sleep. The phenomenology of dreams is largely determined by the status of these circuits. Thereby, the status of these circuits provides an explanation for what we dream and why we dream (Payne & Nadel, 2004). However, cortisol is not the only factor affecting the content and structure of dreams. There has been much speculations about several neurotransmitters that fluctuate across the sleep cycle and affect memory function during wakefulness, and their influence on memory processing during sleep. These neurotransmitters probably interact with cortisol during sleep (Payne & Nadel, 2004). For example, both cortisol and acetylcholine are diminished during non-REM sleep, which seems necessary for episodic memories to undergo effective consolidation (Payne & Nadel, 2004). Moreover, acetylcholine is alone in maintaining brain activation during REM sleep, whereas monoaminergic systems are silent (Becchetti & Amadeo, 2016). Potentially, this observation explains many features of dreams.

The assumption that acetylcholine is another potential modulator of dreams, has arisen by comparing different physiological features of the acetylcholine and norepinephrine systems in the light of the glutamate amplifies noradrenergic effects (GANE) model, with the aim to establish functional differences between REM sleep and waking state (Becchetti & Amadeo, 2017). Acetylcholine (ACh) is a signal molecule in the nervous system, which is involved in

for example contracting muscles and dilating blood in the peripheral nervous system (Biology dictionary, 2019). In the central nervous system, ACh plays a role in several cognitive processes, including memory (Biology dictionary, 2019), which seems to play a critical role in dreaming. The balance in activity between cholinergic and noradrenergic nuclei has global effects that are excitatory and both project varicose fibers that widely innervate the neocortex (Becchetti & Amadeo, 2017). During wakefulness, the ascending fibers releasing acetylcholine and norepinephrine (NE) are highly active. In contrast, the neocortical tone is sustained mainly by acetylcholine during REM sleep, whereas NE activity remains low. That is, high and low concentrations of ACh and NE produce distinct functional effects on neocortical networks (Becchetti & Amadeo, 2017). Low to moderate release of ACh sustains global neocortex arousal in both REM sleep and wakefulness. The evidence that neocortex activation in REM sleep is sustained mainly by acetylcholine indicates that the cholinergic tone is more directly related to executive and consciousness functions (Becchetti & Amadeo, 2017).

Neuronal nicotinic acetylcholine receptors (nAChRs) are suggested to be the biological target of alcohol, which are widely expressed throughout the brain (Feduccia et al., 2012). Binding of endogenous acetylcholine (ACh) results in a conformational change of the receptor. Ethanol can potentiate the response of these receptors to ACh – in that way alcohol operates indirectly as an acetylcholine receptor agonist (Feduccia et al., 2012). Experiments have demonstrated that ethanol directly affects nAChRs and after exposure in long-term, these receptors will potentially undergo functional and anatomical changes. nAChRs plays a significant role in contributing to the rewarding effects of ethanol in brain regions such as hippocampus (Feduccia et al., 2012).

1.5 Research question

On the basis of these findings, it is inferred that alcohol affects brain activity, including sleep architecture and dreams. To date, however, little is known about the correlation between alcohol consumption and the frequency of nightmares. The study of dreams is a formidable task, by cause of that dream consciousness is not accessible through direct observation, only via report (Nir & Tononi, 2010). In addition, it is challenging to manipulate dream content experimentally, whether during sleep or by exposure to stimuli before. Accordingly, it is difficult to predict the contents of specific dreams, such as nightmare (Nir & Tononi, 2010). Additionally, there are not a sufficient number of studies examining the relation between alcohol ingestion and nightmare frequency, according to the damages both factors cause. Due

to these gaps in the literature, the current bachelor thesis aims to examine whether there exists a relationship between alcohol consumption and the frequency of nightmares. When investigating nightmare, bad dream was also included, by reason that the interpretation of whether a dream is a nightmare or a bad dream is subjective. Hence, the research question is “Is alcohol consumption associated with the higher frequencies of nightmares and bad dreams?”. The hypothesis is based on the research presented. The hypothesis in the present study is that there is a positive correlation between alcohol consumption and frequencies of nightmares and bad dreams.

2. Method

2.1 Sample

The sample was recruited by the bachelor students using convenience sampling. This form of sample was appropriate due to its easy accessibility, uncomplicability and quickness (Stratton, 2021). A total of 142 signed up for the study and were receiving the baseline survey, of which 87 completed the baseline survey – the response rate was 61.27%. 17 of the 87 participants did not persist. Not all the remaining participants did complete the survey every day. The age ranged from 20 to 78 of which the average age was 29.27 ($SD = 12.75$). The sample consisted of 47 women ($n = 54\%$) and 40 men ($n = 46\%$).

2.2 Procedure

Recruitment of participants in the current bachelor project occurred from January to the beginning of data collection through several sources such as asking friends, family and fellow students, over social media and through word of mouth. The students in the bachelor project had the responsibility for the recruitment. The participants were given an email informing about the project, including what the project required of the participants and an explanation of the study. The project was presented as a study of dreaming activities, where the participants would need to fill out an online questionnaire about their dreams every morning in four weeks. All participants had to be over the age of 18. Participation was entirely voluntary and anonymous, and the participants could at any time withdraw the consent without giving any reason. The participants were informed that they will create an anonymous username that must be entered each time they fill out the questionnaire, of which the username will be used to link the answers over time. We collected emails to potential responders, but these were only used for recruitment purpose. The emails were not related to the responders' answers, by

cause of the time required using a secure storage service that would have been needed. Therefore, we used usernames in Nettskjema to link the answers over time. The questionnaires did not collect any meta-data related to the participants such as IP addresses. Furthermore, the email informed that the participants would fill out a baseline survey the first day, which was slightly longer and included several demographic questions. From day two until the last day of data collection, they had to fill out “SURVEY 2”. Each daily survey would take about 2 to 10 minutes to complete depending on the amount of information they wanted to report, the email informed. The email encouraged the participants to save the email in their inbox in order to make it easily accessible when they want to fill out the survey the upcoming days. Additionally, the email advised the participants to fill out the survey in a private area, due to the content of the questionnaire consisting of information regarding their sex life, sexual dreams and nightmare experiences. The participants were also told that they will more likely remember their dreams as time goes by, if they don't move around much before writing the dream down, and if they actively think about their dream for a minute after waking up. Data collection began 11th of Mars – on this point all participants had gotten all the necessary information about the study through email. The data collection ended 8th of April. The study was submitted for approval from “Norsk senter for forskningsdata” (NSD) in January and was approved. The participants gave their electronic consent. The number for the notification form to NSD was 637636.

2.3 Instruments

The current project utilized a questionnaire about dreaming activities called “Dreaming record”, a nightmare questionnaire called “Nightmare Experience Questionnaire” (NEQ), and a sexual dream questionnaire called “Sexual Dream Experience Questionnaire” (SDEQ). The questionnaire “Dreaming record” utilized in the current bachelor project were conducted by the leaders for the bachelor project together with the bachelor students. The first draft of the questionnaire got three remarks from NSD we needed to change. Firstly, we had to add some additional information about the conduction of the data collection. Secondly, we needed to write some additional information in the baseline survey the participants would be receiving. Finally, we changed “insomnia” to “poor sleep” in the questionnaire, by reason that suffering of insomnia is considered health data. In addition, we formed some questions as multiple choice questions rather than open questions due to make the time required to fill out the questionnaire shorter. The baseline survey consisted of 17 questions with answer options. This questionnaire included demographic questions about age, gender, if the person is in a

relationship, and if the person is generally sexually satisfied. "SURVEY 2" was similar except these demographic questions. It consisted of 13 questions, for example "How much alcohol did you consume yesterday?", followed by the answer options "high alcohol consumption", "moderate alcohol consumption", "little alcohol consumption" and "no alcohol". Another question was "Did you dream last night", of which the participants would answer whether yes or no. Then, the questionnaire asked "What type of dream was it? Check all that apply". The answer options to this question were "nightmare", "sexual dream", "ordinary dream", "bad dream" and "other". Thus, nightmare and bad dream were two separate variables in the questionnaire. In the analyses, these variables were turned into one variable. If the participants had experienced a nightmare or a sexual dream, they had to fill out a questionnaire regarding this experience – or both if they had experienced both nightmare and sexual dream. These questionnaires, NEQ (Chen et al., 2014) and SDEQ (Chen et al., 2015), were originally in Chinese and thereby they have been translated into English. In the current study these questionnaires were also translated into Norwegian and then translated back to English, in order to make these two versions in English and Norwegian as similar as possible and as precise as possible. Thereby, non-validated Norwegian versions of the instruments were used. The English version of NEQ has been used in studies before (Marquis et al., 2021), and is therefore more valid.

2.3.1. Nightmare Experience Questionnaire

Experience of nightmare was measured with "Nightmare Experience Questionnaire" (NEQ) which is a questionnaire developed by Chen et al. in 2014. NEQ consists of 20 statements related to nightmares and all statements should be rated from 1 to 5. 1 refers to "Very unlike me", 2 refers to "Moderately unlike me", 3 refers to "Somewhat like and unlike me", 4 refers to "Moderately like me", and 5 refers to "Very much like me" (Chen et al., 2014). The participant will circle the number that best describes you. Every statement should be answered. Four items constitute the variable "nightmare", of which several statements constitute the different items which are "physical effect", "negative emotion", "meaning interpretation" and "horrible stimulation". "Physical effect" in NEQ includes for example the statement "I feel physically weaker after having this nightmare". "Horrible stimulation" in NEQ includes for example the statement "In my nightmares, I dreamed about doing something I never do in my daily routines" (Chen et al., 2014). The items constituting the variable nightmare was added together. In the current study some adjustments were made in "Nightmare Experience Questionnaire", mainly on verb tenses in the scales.

2.4 Statistical analyses

All the analyses in the present study were conducted using the IBM Statistical Package for the Social Sciences (IBM SPSS) version 28. To further examine the various variables used in the present study, an analysis of descriptive statistics was carried out. Correlation analysis was used to investigate the hypothesis, caused by two continuously variables. Correlation analysis allows to scrutinize covariation between two variables – consumption of alcohol and frequency of nightmares/bad dreams.

Multiple regression analysis was used to further investigate the hypothesis, more specific the predictive value alcohol consumption has on frequency of nightmares/bad dreams. The dependent variable was nightmare/bad dream, and the predictors were gender, age and alcohol consumption. Multiple regression analysis allows to examine to what extent the predictors, including alcohol consumption, predict the occurrence of nightmares. To operate with multiple regression analysis, a prerequisite is that multicollinearity is not a problem, thereby that the predictor variables do not covary. Accordingly, a bivariate correlation analysis was conducted to examine whether any variables apparent correlated highly.

3. Results

3.1 Descriptive statistics and correlation analysis

Table 1 shows mean, standard deviation and correlations for the variables “gender”, “age”, “alcohol consumption” and “nightmare and bad dream”. The sample consisted of a higher number of women, with the highest frequency in age group 21-25 years. The average score on nightmare/bad dream was 1.74 ($SD = 1.96$) and alcohol consumption had an average score on 0.46 ($SD = 0.41$). There was an insignificant, $p > .05$, negative correlation between variables alcohol consumption and nightmare/bad dream, $r(67) = -.14, p = .266$.

Table 1 – Correlation table*Descriptives statistics and correlations between alcohol and nightmare/bad dream (N = 69)*

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	4
1. Gender	87	1.46	0.50	--	.09	.13	-.16
2. Age	85	29.27	12.75	.09	--	.00	-.10
3. Alcohol consumption	66	0.46	0.41	.13	.00	--	-.14
4. Nightmare and bad dream	69	1.74	1.96	-.16	-.10	-.14	--

Note: Correlation values have been rounded to the second decimal place. All correlations are insignificant ($p < .05$).

3.2 Multiple linear regression analysis

The correlations between the predictors do not indicate multicollinearity, according to the criteria of multicollinearity presented by Field (2018). These criteria identify that correlations between the predictors should be .80 or above. The strongest correlation found was between nightmare/bad dream and gender, $r(62) = -.17$, $p = .097$. Furthermore, Hutcheson & Sofronio (1999) constant that having a variance inflation factor (VIF) of 4 or greater also indicate if the predictors share too much common variance which is not the case in the current study. VIF for all the variables were below 1.02. VIF for alcohol consumption was 1.01. General guidelines state that there is cause for concern if the maximum value of VIF is greater than 10, or if the average VIF value is significantly higher than 1, as this may assume the regression as biased (Field, 2017). Additionally, observing “tolerance” can diagnose multicollinearity, of which “tolerance” below .2 indicates a potential problem, and “tolerance” below .1 indicates a serious problem (Field, 2017). In the current regression analyses, all the variables scored greater than .99, which do not indicate a problem. “Tolerance” for alcohol consumption was .99. Consequently, it was concluded in the current multiple regression analysis that multicollinearity was not a problem. Nevertheless, a prerequisite for conducting a regression analysis is that the dependent variable is continuous. Nightmare/bad dream is not a continuously variable, meaning that this regression analysis does not meet all the prerequisites. Therefore, caution interpretation of the results is needed.

Both the regression models were non-significant and had poor explanatory ability of the variance. Model 1 including the predictors gender and age, had no significant effect on the outcome and explained 4% of the total variance in the outcome of frequency of nightmares/bad dreams, ($R^2 = .04$, $F(2, 61) = 1.31$, $p = .279$). Age was the strongest predictor, had no significant effect, and the standardized Beta was negative ($\beta = -0.12$, $p = .350$). The standardized Beta of gender was negative and had no significant effect ($\beta = -0.16$, $p = .213$). Model 2 added the predictor alcohol consumption, which now explained 5% of the variance in the frequency of nightmares/bad dreams ($R^2 = .05$, $F(3, 60) = 1.14$, $p = .342$). Model 2 was insignificant. The strongest predictor of nightmare/bad dream, which was insignificant and had negative standardized Beta, was alcohol consumption, ($\beta = -0.11$, $p = .373$). Both gender ($\beta = -0.15$, $p = .251$) and age ($\beta = -0.12$, $p = .349$) had no significant effect and the standardized Beta was negative.

Table 2 – Multiple regression analysis

Multiple Regression Analysis Summary for Predicting Nightmare/Bad dream (N = 64)

Variable	<i>b</i>	<i>SE b</i>	β	R^2	ΔR^2
Model 1				.04	.01
Gender	-0.60	0.48	-0.16		
Age	-0.02	0.02	-0.12		
Model 2				.05	.01
Gender	-0.56	0.48	-0.15		
Age	-0.02	0.02	-0.12		
Alcohol consumption	-0.53	0.59	-0.11		

Note: Coefficient values have been rounded to the second decimal place. No significant effects ($p < .05$)

4. Discussion

4.1 Summary of findings

The purpose of this study was to investigate whether alcohol consumption is associated with the higher frequencies of nightmares and bad dreams. The results of the correlation analysis

demonstrate a weak negative non-significant correlation between alcohol consumption and nightmare/bad dream, contrary to what was anticipated by the hypothesis. Nor did the results of the regression analysis establish a substantial explanatory value of the models made. Alcohol consumption, age and gender explained 5% of the variance in frequency of nightmares/bad dreams, which was 1% more than what age and gender explained alone. These results were non-significant and indicate that alcohol consumption has poor predictive ability on frequency of nightmares/bad dreams. This is also contrary to expectations based on the hypothesis. Thereby, the current study did not find support to the hypothesis based on what previous research has implied, that alcohol consumption is associated with the higher frequency of nightmares/bad dreams. However, the results should be interpreted with caution due to several methodological limitations that will be further elaborated in the following discussion.

4.2 The hypothesis and findings

The central hypothesis in the current study suggested that there is a positive correlation between alcohol consumption and frequencies of nightmares and bad dreams. No significant findings and no associations between alcohol use and nightmare/bad dream occurrences were found – the hypothesis was not supported, which does not support previous research. These findings are in accordance with a study conducted by Rek et al. (2017), where no associations between nightmare occurrences and alcohol use were found. Nonetheless, PTSD and milder forms of waking life stressors were found to precipitate the occurrence of nightmares (Rek et al., 2017). The study was subject to limitations which might have provided biased results. For example, the sample was not representative of the general population and there was a possibility that participants with sleep problems were more likely to complete the study since the study was advertised as a “sleep survey about dreams and nightmares” (Rek et al., 2017).

However, the current study did not support previous research postulating that there is an association between alcohol consumption and experiencing nightmares/bad dreams. As many previous studies have shown, alcohol inflicts changes in cerebral activity through the brain which affect the content of dreams (Squeglia et al., 2014; Drew et al., 2015; Wrase et al., 2008). Variations in concentration of cortisol during the night influence memory consolidation during sleep, a biological process assumed to reflect dreams, by determining the functional status on the circuits of hippocampal and neocortical (Payne & Nadel, 2004). Acetylcholine is another potential modulator of dreams, of which high and low concentrations produce distinct effects on neocortical network, which might can explain the functional

differences between waking state and REM sleep (Becchetti & Amadeo, 2017). Moreover, ACh binding to nAChRs induce a conformational change of nAChRs, and alcohol undoubtedly potentiates nAChRs in response to ACh (Feduccia et al., 2012). nAChRs plays a role in the rewarding effects in different brain regions, including hippocampus (Feduccia et al., 2012). In addition, alcohol affects asymmetry in hippocampus (Mattson et al., 2001) – hippocampal neural activity during REM sleep is critically involved in memory consolidation, and thereby hypothetically in dreams. Furthermore, nightmare is more likely to occur after consuming alcohol, due to its increasing effect on late night REM sleep which increase the opportunity for longer and more vivid dreams to occur (Steinig et al., 2011; Oudiette et al., 2012; Rek et al., 2017). Additionally, many studies have reported that the subjective dream experience is more negatively toned in patients with alcohol abuse compared with healthy controls (Steinig et al., 2011). There is also evidence to suggest that the occurrence of nightmares is affected by alcohol, based on that dreaming may unfold in a state of emotional experiences, and that alcohol affects brain regions involved in emotions, including amygdala (Wrase et al., 2008; Aziz & Green, 2016; Yu et al., 2015; Blake et al., 2019).

Limitations in our measures may be potential reason for previous results not being replicated. Restrictions from NSD did not allow us to examine associations between nightmare and variables considered as health data. Thereby, involving variables as stress or mental disorders such as post-traumatic stress disorder (PTSD) in the analyses were not allowed, which are factors assumed to affect REM sleep (Mellman et al., 2014). Nightmares are a hallmark and symptom of post-traumatic stress disorder, of which as many as 50% of trauma-exposed adults are affected (Campbell & Germain, 2016). Additionally, several studies have shown a correlation between alcohol dependence and PTSD (Debell et al., 2014). Adult Psychiatric Morbidity Survey (APMS) found in 2007 that PTSD and alcohol dependence were moderately correlated. The National Comorbidity Survey (1990-1992) reported a prevalence of comorbid PTSD in those with alcohol dependence of 26.2% in women and 10.3% in men, in the US general population. Debell et al. (2014) found in a review that at least 10% of individuals with PTSD have comorbid with alcohol misuse and demonstrated that alcohol misuse and PTSD are frequently associated across a range of populations. There are also studies demonstrating that alcohol consumption and the risk for developing alcohol use disorders (AUDs) increase by exposure to stress (Keyes et al., 2012). Furthermore, findings suggest that exposure to stress, as death of significant others and exam stress, can be a cause of more frequent nightmares (Rek et al., 2017). During the Covid-19 pandemic, there has

been reported a general increase in nightmare frequency, of which stress is a substantial factor (Kennedy et al., 2021). Both norepinephrine and cortisol influence brain systems involved in memory, which hypothetically is involved in dreams (Payne & Nadel, 2004), and are significantly involved in stress-responses (Hellhammer et al., 2009). PTSD-related nightmare frequency may be a result of decreased norepinephrine (Kennedy et al., 2021). Also, a blunted cortisol awakening response is associated with frequent nightmares (Kennedy et al., 2021).

That means, potential explanatory variables for occurrence of nightmares or not occurrence of nightmares were not including in the current study. The problem excluding such variables, is the decreasing effect on the validity and the reliability of the study since they are factors that could plausibly contribute to the triggering of nightmares, by cause of their great impact on both alcohol use and experience of nightmares. Exclusion of these variables may imply biased results.

4.3 Strengths and limitations

There are several clear limitations in the present study. A major limitation of the current study is the use of convenience method for sampling and the small sample size ($N = 87$), constituting low representativeness (Etikan et al., 2016; Shen et al., 2011). There is also an issue with somewhat low statistical power in the study, which enhances the risk for Type II-errors, i.e. false negative results (Field, 2018). Further, low representativeness implies low generalizability of the results to the population (Lakes, 2013; Shen et al., 2011). These factors can be of explanatory value for the interpretation of the results and can have made it more difficult to obtain significant results. Convenience method for sampling includes responders of the population who are available to the researcher (Naderifar et al., 2017). Many professionals argue that convenience sampling is the weakest method of sampling, due to its risk of bias in nonhomogeneous populations (Naderifar et al., 2017). Furthermore, a dependence relationship can occur as a consequence of using convenience method for sampling. The people the researcher asks to participate may feel compelled to participate caused by their relationship. This is contrary to research ethics principles, and it will potentially cause low motivation among the participants which leads to higher possibility for lower response rate. Further, this will cause lower reliability. Future studies will benefit from more representative samples, for example using patient populations including individuals experiencing frequent nightmares or alcohol consumption.

Another limitation to this bachelor project is related to the definition of nightmare. The participants were not told that the variables nightmare and bad dream were merged into one

variable in the analyses, because we did not know until data collection ended. Accordingly, they had to relate to the two variables when answering questions. It exists disagreements about one holistic definition of nightmare, which has led to unequal definitions in different studies. Moreover, the experience of whether a dream is a nightmare or not is subjective. Hence, nightmare is a measure on the individual's perception of nightmare, not an actual measure of nightmare. Thereby, the results represent the subjective interpretation of nightmares, not the actual occurrence of nightmares. The lack of operationalization indicates lower reliability in the study. Future studies will benefit from an operationalization of nightmare, to avoid including the variable bad dream, due to securitize the association between alcohol consumption and nightmare frequency.

Further, a limitation to the study is that not all participants did fill out the questionnaire every day as they were supposed to. This notion makes the study less reliable and generalizable due to lower representativeness. There are several potential causes why many participants did not fill out the questionnaire every day, such as not sufficient information about the importance of filling out the questionnaire every day to get more reliable results, the time required filling out the questionnaire was too long, or the participants had low motivation. Further studies should include a reminder to the participants that make sure they fill out the questionnaire every day. Furthermore, both questions about alcohol consumption and occurrences of nightmare/bad dream can be considered as sensitive themes for some participants. Toruangeau, Rips and Rasinski (2000) determine that the participants' answers on questions related to sensitive themes may lead to challenging consequences. Consequences of questions involving sensitive themes are systematic errors reducing response rate, for example caused by social desirability (Tourangeau & Yan, 2007). Additionally, social desirability may have occurred as a result of the use of self-reporting, due to people's desire to present a favorable image of themselves (Van de Mortel, 2008). However, it is conceivable that social desirability in electronic questionnaire is not as big a problem as in physical questionnaires, due to the opportunity of anonymity and answering questionnaires in private areas.

However, a strength to the study is the sample consisting of great spread in gender and age, which increases the generalizability to population level. The sample consisted of higher frequencies of women than men, but it was not problematic, due to the distribution was not much skewed. Another strength of the current study is the form of the questions in the questionnaire. Most questions were the type of multiple choice, which precipitated the time required to fill out the questionnaire curtailed. This further increases generalizability of the

study, due to its increasing effect on the response rate (Kennedy et al., 2019). Furthermore, the instrument measuring nightmare included in the study, “Nightmare Experience Questionnaire” (NEQ), has good reliability, according to Langdridge (2015) who claims that the score on Cronbach’s alpha should be over .7 for reliable scales. All the items in NEQ that constitute the variable nightmare, including “physical effect”, “negative emotion”, “meaning interpretation” and “horrible stimulation”, have a Cronbach’s alpha of .7 or above (Chen et al., 2014). The Norwegian version of NEQ, however, was not valid caused by it has never been used in studies before. Moreover, participation was anonymous and voluntary. Anonymity ensures that the participants do not hesitate to answer sensitive themes, which increase the response rate. Additionally, anonymity may lead to higher levels of honesty, which increases the validity and reliability of the study (Nicol & Paunonen, 2002). Voluntariness may lead to higher levels of autonomy, which further conduce heightened levels of motivation (Deci & Ryan, 2012). Increased motivation will increase the probability for the participants to answer the questionnaire every day and complete the study. This further increase the study’s validity and reliability.

4.4 Implications for future research

The present bachelor project has established that further research is necessary to provide more thorough comprehension of the relation between alcohol consumption and the experience of nightmares/bad dreams, and to clarify if one such relation actual exists. Several studies have established that consuming alcohol causes changes in cerebral activity (Squeglia et al., 2014), and that particular dream characteristics activate selective brain regions during sleep (Desseilles et al., 2011). Thereby, nightmare may reflect a particular pattern of cerebral activity. However, the potential association between nightmare experience and alcohol consumption has not been adequately studied. The results of the current study showed a non-significant negative correlation between alcohol consumption and nightmare/bad dream frequencies, and alcohol consumption showed non-significant poor predictive value on nightmare/bad dream frequencies. The results might reflect methodological limitations which further research should take into consideration.

Future research should include an operationalization of nightmare due to its subjective interpretation. Operationalization of nightmare leads to the possibility to dismiss the variable bad dream. As previous research has shown, nightmare and bad dream indicate differences in the measures of psychological well-being, of which nightmare frequencies significantly correlates more with well-being than frequencies of bad dream (Zadra & Donderi, 2000). Due

to the differences caused by nightmare frequencies and bad dream frequencies, studies only focusing on the relation between nightmare frequencies and alcohol consumption are necessary to provide more precise results and specific knowledge on how these elements work together. This will further provide insight into preventive measures and health promotion work related to reduced alcohol tendencies and nightmare occurrences. This may further lead to a reduction of distress in everyday life and improved well-being among individuals (Zadra & Donderi, 2000; Nielsen & Zadra, 2005).

Furthermore, investigating the relation between alcohol consumption and nightmare experiences, can be done through scrutinizing factors that account for their relationship, by determining specific factors that constitute both nightmares and alcohol consumption. Evidence suggests that stressful and traumatic experiences are of great importance for both nightmare occurrences and alcohol consumption (Campbell & Germain, 2016; Debell et al., 2014; Keyes et al., 2012; Rek et al., 2017). Including such factors will contribute to a holistic understanding of the phenomena, by cause of their explanatory value.

4.5 Conclusion

In conclusion, the current bachelor thesis examined the association between alcohol consumption and the occurrence of nightmares/bad dreams through the research question “Is alcohol consumption associated with the higher frequencies of nightmares and bad dreams?”. The results exhibited no significant association, nor any significant predictive value for alcohol on the occurrence of nightmares and bad dreams. The results should, however, be interpreted with caution due to several methodological limitations. Lack of explanatory factors exists in the current study, such as exposure to stress or traumatic experiences. The relation not being discovered can also be explained through weaknesses of the current operationalizations and the low generalizability attributed to the sample. All things considered, the current bachelor thesis illustrates the need for further investigating and comprehension of the association between alcohol consumption and nightmare/bad dream occurrences. This will provide important insight into these phenomena that further can prevent increasing tendencies of alcohol use and occurrence of nightmares.

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